(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 196 861 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **18.09.91** (51) Int. Cl.5: **B05D 3/06**

(21) Application number: **86302189.5**

(22) Date of filing: **25.03.86**

(54) **Method of supporting a louvered plastic film.**

(30) Priority: **29.03.85 US 717820**

(43) Date of publication of application:
08.10.86 Bulletin 86/41

(45) Publication of the grant of the patent:
18.09.91 Bulletin 91/38

(84) Designated Contracting States:
DE FR GB IT SE

(56) References cited:

EP-A- 0 142 312	WO-A-81/02262
DE-A- 1 594 193	DE-A- 2 031 706
DE-A- 3 138 884	FR-A- 2 167 956
GB-A- 1 576 911	US-A- 3 653 138
US-A- 3 707 416	US-A- 3 919 559
US-A- 3 922 440	US-A- 4 128 685
US-A- 4 181 752	US-E- 27 617

(73) Proprietor: **MINNESOTA MINING AND MANUFACTURING COMPANY**
3M Center, P.O. Box 33427
St. Paul, Minnesota 55133-3427(US)

(72) Inventor: **Fox, Frederick J. c/o Minnesota Mining and**
Manufacturing Co. 2501 Hudson Road P.O. Box 33427
St. Paul Minnesota 55133-3427(US)

(74) Representative: **Baillie, Iain Cameron et al**
c/o Ladas & Parry Isartorplatz 5
W-8000 München 2(DE)

EP 0 196 861 B1

Description

Technical Field

The invention provides a method of supporting a louvered plastic film to permit it to be handled and transported without danger of damage. As supported, the louvered plastic film should be more convenient to apply to typical uses than are louvered plastic films now on the market. The supporting structure produced by the novel method is a composite.

Background Art

US-E- 27,617 (Olsen) discloses a process of making a louvered light control film by skiving a billet of alternating layers of plastic having relatively low (clear) and relatively high (pigmented) optical densities. Upon skiving the billet, the pigmented layers provide light-collimating louver elements which, as illustrated in the patent, may extend orthogonally to the surface of the resulting louvered plastic film. US-A-3,707,416 (Stevens) discloses a process whereby the light-collimating louver elements may be canted with respect to the surface of the louvered plastic film. US-A-3,919,559 (Stevens) teaches a process for attaining a gradual change in the angle of cant of successive light-collimating louver elements.

Among uses for louvered plastic films are as lenses in goggles as shown in US-A- 3,791,722 (Ahlberg et al.) to be worn where high levels of illumination or glare are encountered. When used as a transparent covering for a back-lighted instrument panel, a louvered plastic film minimizes reflections, e.g., from being cast onto the windshield of an automobile. A louvered plastic film can also be used to give a black-and-white photographic negative the appearance of a positive made from the negative, as taught in USA 3,653,138 (Cooper).

US-A- 4,128,685 (Lowrey et al.) reports that billets from which louvered plastic films have been skived often are heated during the skiving, but that the heat "may tend to be absorbed preferentially by the opaque louver material so that the billet employed is softer along the louver lines than along the clear or transparent lines" (col. 1, lines 13-21). The patent teaches how to select materials for the billet so that the alternating clear and pigmented (opaque) layers have relatively uniform heat absorptive ability. The preferred material for the pigmented layers comprises self-crosslinking anionic acrylates, water-soluble polyazo direct dyes such as "Formanil Black G", and finely divided silica.

US-A- 3,922,440 (Wegwerth et al.) points out that because louvered plastic films "are thin sheet materials: (1) they are not by themselves capable of structurally withstanding extreme stresses and (2) they are subject to distortion from physical stress and temperatures" (col. 1, lines 19-22). Furthermore, the skiving by which the louvered plastic films are produced results in irregular surfaces. Accordingly, as in Example 1 of that patent, the louvered plastic film usually is laminated under pressure between two clear plastic films, e.g., cellulose acetate butyrate, the material usually used in making louvered plastic films. Typically, the louvered plastic film is skived to a thickness from 0.2 to 0.4 mm, and each of the outer clear plastic films has a thickness of about 0.15 to 0.3 mm.

Wegwerth's process of laminating louvered plastic films between two clear films requires an expensive press that is expensive to operate, in part from the need to distribute heat uniformly, and in part from the need to apply pressure with precision. Because the resulting laminates cannot be larger than the platens of the press in which they are laminated, the press must be sufficiently large and expensive to produce the largest required size.

A further prior art that is of interest is that disclosed in DE-A-3 138 884. According to this disclosure louvered filters can be made from a stack of light transmitting ribbons, there being a ribbon of opaque material between each pair of adjacent ribbons of light transmitting material. The resulting stack of ribbons is drawn through a die to compress the ribbons together. At least one of the materials may be a thermoplastic material to enable the ribbons to be unified without the use of additional bonding means. To the back and front of the resulting louvered filter sheet there can be glued or welded a covering sheet of transparent material to give stability to the stack of ribbons. There is no suggestion that such glueing or welding is not of a permanent nature.

Disclosure of Invention

The invention provides an inexpensive method for supporting a louvered plastic film so that it can be handled and put to use with very little danger of damage. The resulting composite can be produced in substantially continuous lengths that can be wound up for convenient storage or shipment and later unwound and cut to specific lengths with substantially no waste.

Briefly, the novel method comprises the steps of

1) coating the louvered plastic film with a solvent-free monomer composition which polymerizes upon exposure to ultraviolet radiation to an adhesive (preferably transparent) state, and

2) exposing the coating to ultraviolet radiation to polymerize the composition.

The composite of the present invention comprises a louvered plastic film and adjacent said louvered film a pressure-sensitive adhesive.

Preferably the monomer composition polymerizes to a pressure-sensitive adhesive state for convenience in bonding the louvered plastic film to a supporting member. Surprisingly, a pressure-sensitive adhesive layer as thin as 0.01 mm provides adequate support for a louvered plastic film. However, an adhesive layer of somewhat greater thickness, e.g., from 0.04 to 1.5 mm, is preferred to allow for surface irregularities of the louvered plastic film when bonding it to a supporting member.

Because the monomer composition may be polymerizable only in the absence of air, it may be covered by a transparent plastic film to protect it from air, and the coating may then be exposed through the transparent plastic film. When that transparent plastic film is abrasion-resistant, it may remain as a permanent layer of the resulting composite. Instead, the plastic film can have a release surface permitting it later to be peeled away to expose the adhesive layer by which the louvered plastic film can then be adhered to another supporting member such as a glass plate or a plastic sheet. Useful plastic sheets include polycarbonate, polymethylmethacrylate, polystyrene, and biaxially-oriented polyethylene terephthalate, all of which are clear and transparent. Of these, polycarbonate is preferred, because it is flexible and has excellent clarity and resistance to heat.

Whether or not the transparent plastic film is removable, an end-user may screen-print a design or message directly onto the opposite, exposed surface of the louvered plastic film and then overcoat that entire surface and its printing with an optically clear layer. Ordinarily, the composite would then be mounted for use with the printed surface protected from contact.

Both surfaces of a louvered plastic film may be coated with an ultraviolet-polymerizable composition, and after covering each coating with a transparent plastic film, both coatings may be simultaneously exposed to ultraviolet radiation. Preferably one of those transparent plastic films is selected to become firmly bonded to the adhesive layer when it is polymerized, thus lending greater strength to the composite.

Brief Description of Drawings

In the drawing, all figures of which are schematic:

Fig. 1 shows an apparatus for applying an adhesive layer to a louvered plastic film to provide a composite of the invention.

Fig. 2 is an edge view of another composite of the invention; and

Fig. 3 is an edge view showing a use of the composite of Fig. 2.

In Fig. 1, a louvered plastic film 10 and a transparent plastic film 12 are being fed into a 2-roll coater 14 while a monomer composition from an extrusion bar 16 forms a coating 17 on the louvered plastic film. Upon passing beneath a bank of ultraviolet lamps 18, the monomer composition polymerizes to an adhesive state, and the resulting composite is wound upon itself into a roll 19. When the transparent plastic film 12 has a release surface contacting the polymerized coating 17, it may be peeled from the coating to allow the louvered plastic film 10 to be adhered by the exposed adhesive coating to a substrate.

The composite 20 shown in Fig. 2 has a central louvered plastic film 21, a pair of adhesive coatings 22, 23, and a pair of transparent plastic films 24, 25 through which the adhesive coatings have been exposed to ultraviolet radiation from two banks of lamps (not shown), one facing each broad surface of the composite.

The composite 20 of Fig. 2 may be used as illustrated in Fig. 3 by peeling off and discarding one of the transparent plastic films 24 and adhering the exposed adhesive coating 22 to a bezel of an instrument panel 30. The other transparent plastic film 25, which may be a polycarbonate film, remains permanently in place to protect the louvered plastic film 21. A decorative covering 32 protects the exposed edges of the louvered plastic film 21.

Example 1

A louvered plastic film was prepared as described in US-A- 4,128,685 at column 2, lines 27-49. As there disclosed, its light-collimating louver elements comprise a mixture of finely divided silica and an unpurified black polyazo dye directly dispersed in an acrylate, its clear layers were cellulose acetate butyrate, and its thickness was about 0.15 mm. Onto one surface of the louvered plastic film was applied a coating (0.05 mm thick) of a partially polymerized blend of

90 parts of isooctyl acrylate
10 parts of acrylic acid
0.2 parts of photoinitiator
0.1 part of photoactive crosslinking agent.

The photoinitiator was 2,2-dimethoxy-2-phenyl acetophenone ("Irgacure 651"). The photoactive crosslinking agent was "Photoactive S-triazine B" of US-A- 4,330,590.

After covering the coating with a disposable transparent polyester film having a release surface, the coating was irradiated by a bank of 40-watt fluorescent black light lamps, i.e., F40T12/BL Sylvania, to provide an exposure of 400 millijoules, thus polymerizing the coating to a pressure-sen-

sitive adhesive state. The resulting 3-layer composite was wound upon itself into roll form.

After removing the disposable transparent plastic film from a piece of the composite, its adhesive layer was used to laminate the louvered plastic film to biaxially oriented poly(ethylene terephthalate) film, the surface of which had been coated with polyvinylene chloride. With the louvered plastic film of the resulting composite against a rigid back plate, the polyester film was peeled back in an Instron Tensile Tester at the rate of 0.5 cm/sec. Resistance to peelback was about 90 to 110 N/dm, showing that the adhesive coating had become strongly bonded to the louvered plastic film.

In contrast, when a comparable preformed pressure-sensitive adhesive layer was transferred to an identical louvered plastic film, the resistance to peelback was on the order of 10 N/dm.

After removing the disposable film from another piece of the composite of this example, its exposed adhesive was used to laminate the louvered plastic film to a piece of polycarbonate film 0.5 mm in thickness. This composite was adhered to a bezel of a back-lighted instrument panel as in Fig. 3, with the louver elements extending horizontally. In a darkened room, no reflections were observed on a pane of glass positioned to simulate the windshield of an automobile.

After removing the disposable film from another piece of the composite of this example, it was suspended vertically in an oven at 65° C for 7 days. No observable change occured. In contrast, an identical piece of louvered plastic film without any adhesive coating became physically deformed.

After removing the disposable film, a fresh piece of the composite of this example was suspended vertically in an oven at 38° C and 100% relative humidity for 7 days. No observable change occurred. In contrast, an identical piece of louvered plastic film without any adhesive coating split.

Claims

1. Method for supporting a louvered plastic film, (10, 21) which method comprises the steps of
   1) coating the louvered plastic film (10, 21) with a solvent-free monomer composition which polymerizes upon exposure to ultraviolet radiation to an adhesive state, and
   2) exposing the coating (17, 22, 23) to ultraviolet radiation to polymerize the composition.

2. Method as defined in claim 1 wherein the monomer coating (17, 22, 23) is covered by a transparent plastic film (12, 24, 25) to protect it from air during step 2).

3. Method as defined in claim 2 wherein the transparent plastic film (12, 24, 25) is selected to become permanently bonded to the polymerized composition.

4. Method as defined in claim 2 wherein the transparent plastic film (12, 24, 25) has a release surface permitting it later to be peeled away to expose the adhesive coating (17, 22, 23).

5. Method as defined in claim 4 including the subsequent steps of peeling away the transparent plastic film (12, 24, 25), and employing the exposed adhesive coating (17, 22, 23) to bond the louvered plastic film (10, 21) to a transparent supporting member (30).

6. Method as defined in claim 5 wherein the transparent supporting member (12, 24, 25) is a sheet of polycarbonate.

7. Method as defined in claim 1 wherein the monomer composition polymerizes to a pressure-sensitive adhesive state.

8. Method as defined in claim 7 wherein the thickness of the resulting pressure-sensitive adhesive coating (17, 22, 23) is from 0.01 to 1.5 mm.

9. Method as defined in claim 1 including the subsequent steps of screen-printing a design or message directly onto the exposed surface of the louvered plastic film (10, 21) and then overcoating the printed face with an optically clear layer.

10. Method as defined in claim 1, step 1) of which includes coating (17, 22, 23) both surfaces of the louvered plastic film (10, 21) with an ultraviolet-polymerizable composition, and step 2) includes exposing both coatings (17, 22, 23) to ultraviolet radiation.

11. Composite comprising a louvered plastic film (10, 21) and a pressure sensitive adhesive coating (17, 22, 23) adjacent said louvered film.

12. Composite as defined in claim 11, the adhesive coating (17, 22, 23) of which is protected by a transparent plastic film (12, 24, 25).

13. Composite as defined in claim 12 wherein the transparent plastic film (12, 24, 25) has a release surface permitting it to be peeled from the adhesive coating (17, 22, 23) and dis-

carded.

14. Composite as defined in claim 12 wherein the transparent plastic film (12, 24, 25) is permanently bonded by the adhesive coating (17, 22, 23) to the louvered plastic film (10, 21).

15. Composite as defined in claim 14 wherein the transparent plastic film (12, 24, 25) is polycarbonate.

16. Composite comprising a louvered plastic film and an adhesive coating, characterized in that said coating is a solvent-free monomer composition that polymerizes upon exposure to radiation to an adhesive state.

17. Composite as defined in claim 17 wherein said radiation is ultraviolet radiation.

Revendications

1. Procédé pour supporter un film de plastique (10, 21) pourvu de fentes, comprenant les étapes consistant à:
   1°) revêtir le film de plastique (10, 21) à fentes d'une composition monomère sans solvant, qui polymérise, lorsqu'elle est exposée au rayonnement ultraviolet, dans un état adhésif, et
   2°) exposer le revêtement (17, 22, 23) au rayonnement ultraviolet pour polymériser la composition.

2. Procédé selon la revendication 1, dans lequel le revêtement monomère (17, 22, 23) est recouvert par un film plastique transparent (12, 24, 25) pour le protéger de l'atmosphère pendant l'étape 2.

3. Procédé selon la revendication 2, selon lequel le film plastique transparent (12, 24, 25) est choisi pour pouvoir adhérer de façon permanente à la composition polymérisée.

4. Procédé selon la revendication 2, selon lequel le film plastique transparent (12, 24, 25) a une surface anti-adhésion permettant de peler le film par la suite pour mettre à nu le revêtement adhésif (17, 22, 23).

5. Procédé selon la revendication 4, comprenant les étapes suivantes consistant à peler le film plastique transparent (12, 24, 25) et employer le revêtement adhésif à nu (17, 22, 23) pour coller le film plastique à fentes (10, 21) à un élément de support transparent (30).

6. Procédé selon la revendication 5, selon lequel l'élément de support transparent (12, 24, 25) est une feuille de polycarbonate.

7. Procédé selon la revendication 1, selon lequel la composition monomère polymérise en un état adhésif sensible à la pression.

8. Procédé selon la revendication 7, selon lequel L'épaisseur du revêtement adhésif (17, 22, 23) sensible à la pression va de 0,01 à 1,5 mm.

9. Procédé selon la revendication 1, comprenant les étapes suivantes consistant à sérigraphier un dessin ou un message directement sur la surface à nu du film plastique à fentes (10, 21) puis à recouvrir la surface imprimée d'une couche optiquement transparente.

10. Procédé selon la revendication 1, selon lequel L'étape 1 comprend le revêtement (17, 22, 23) des deux surfaces du film plastique à fentes (10, 21) avec une composition polymérisable au rayonnement ultraviolet, et l'étape 2 comprend l'exposition des deux revêtements (17, 22, 23) au rayonnement ultraviolet.

11. Composite comportant un film plastique à fentes (10, 21) et un revêtement adhésif sensible à la pression (17, 22, 23) contigu audit film à fentes.

12. Composite selon la revendication 11, dont le revêtement adhésif (17, 22, 23) est protégé par un film plastique transparent (12, 24, 25).

13. Composite selon la revendication 12, dans lequel le film plastique transparent (12, 24, 25) a une surface anti-adhésive permettant de L'arracher du revêtement adhésif (17, 22, 23) et de le jeter.

14. Composite selon la revendication 12, dans lequel le film plastique transparent (12, 24, 25) est collé de façon permanente par le revêtement adhésif (17, 22, 23) au film plastique à fentes (10, 21).

15. Composite selon la revendication 14, dans lequel le film plastique transparent (12, 24, 25) est en polycarbonate.

16. Composite comprenant un film plastique à fentes et un revêtement, caractérisé en ce que ledit revêtement est une composition monomère sans solvant qui polymérise sous exposition à un rayonnement en un état collant.

17. Composite selon la revendication 17, dans lequel ledit rayonnement est un rayonnement ultraviolet.

Patentansprüche

1. Verfahren zm Abstützen einer geschlitzten Kunststoffolie (10, 21) mit folgenden Schritten:
   1) die geschlitzte Kunststoffolie (10, 21) wird mit einer lösungsmittelfreien Monomerzusammensetzung überzogen, die unter der Einwirkung einer Ultraviolettstrahlung in einen klebfähigen Zustand polymerisiert und
   2) zum Polymerisieren der Zusammensetzung wird der Überzug (17, 22, 23) einer Ultraviolettstrahlung ausgesetzt.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Monomerüberzug (17, 22, 23) zu seinem Schutz vor Luft während des Schrittes 2) mit einer durchsichtigen Kunststoffolie (12, 24, 25) abgedeckt wird.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die durchsichtige Kunststoffolie (12, 24, 25) so ausgewählt wird, daß sie mit der polymerisierten Zusammensetzung dauerhaft stoffschlüssig verbunden wird.

4. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die durchsichtige Kunststoffolie (12, 24, 25) eine Antihaftfläche hat, die ein späteres Abziehen der durchsichtigen Kunststoffolie (12, 24, 25) zum Freilegen des Klebstoffüberzuges (17, 22, 23) gestattet.

5. Verfahren nach Anspruch 4, in dem in darauffolgenden Schritten die durchsichtige Kunststoffolie (12, 24, 25) abgezogen und der freiliegende Klebstoffüberzug (17, 22, 23) zum stoffschlüssigen Verbinden der geschlitzten Kunststoffolie (10, 21) mit einem durchsichtigen Stützglied (30) verwendet wird.

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß das durchsichtige Stützglied (12, 24, 25) ein Blatt aus Polycarbonat ist.

7. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Monomerzusammensetzung in einen Haftkleberzustand polymerisiert.

8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß der gebildete Haftkleberüberzug (17, 22, 23) eine Dicke von 0,01 bis 1,5 mm hat.

9. Verfahren nach Anspruch 1, in dem in darauffolgenden Schritten ein Muster oder eine Nachricht im Siebdruck direkt auf die freiliegende Fläche der geschlitzten Kunststoffolie (10, 21) aufgebracht und danach die bedruckte Fläche mit einer optisch klaren Schicht überzogen wird.

10. Verfahren nach Anspruch 1, in dem im Schritt 1) die geschlitzte Kunststoffolie (10, 21) auf beiden Flächen mit einer ultraviolettpolymerisierbaren Zusammensetzung überzogen (17, 22, 23) wird und im Schritt 2) beide Überzüge (17, 22, 23) einer Ultraviolettstrahlung ausgesetzt werden.

11. Verbundstoff mit einer geschlitzten Kunststoffolie (10, 21) und einem ihr benachbarten Haftkleberüberzug.

12. Verbundstoff nach Anspruch 11, in dem der Kleberüberzug (17, 22, 23) durch eine durchsichtige Kunststoffolie (12, 24, 25) geschützt ist.

13. Verbundstoff nach Anspruch 2, dadurch gekennzeichnet, daß die durchsichtige Kunststoffolie (12, 24, 25) eine Antihaftfläche besitzt, die es ermöglicht, daß die durchsichtige Kunststoffolie von dem Kleberüberzug (17, 22, 23) abgezogen und weggeworfen wird.

14. Verbundstoff nach Anspruch 12, dadurch gekennzeichnet, daß die durchsichtige Kunststoffolie (12, 24, 25) durch den Kleberüberzug (17, 22, 23) mit der geschlitzten Kunststoffolie (10, 21) bleibend stoffschlüssig verbunden ist.

15. Verbundstoff nach Anspruch 14, dadurch gekennzeichnet, daß die durchsichtige Kunststoffolie (12, 24, 25) aus Polycarbonat besteht.

16. Verbundstoff mit einer geschlitzten Kunststoffolie und einem Überzug, dadurch gekennzeichnet, daß der Überzug aus einer lösungsmittelfreien Monomerzusammensetzung besteht, die bei Bestrahlung in einen klebfähigen Zustand polymerisiert.

17. Verbundstoff nach Anspruch 17, dadurch gekennzeichnet, daß die genannte Strahlung eine Ultraviolettstrahlung ist.

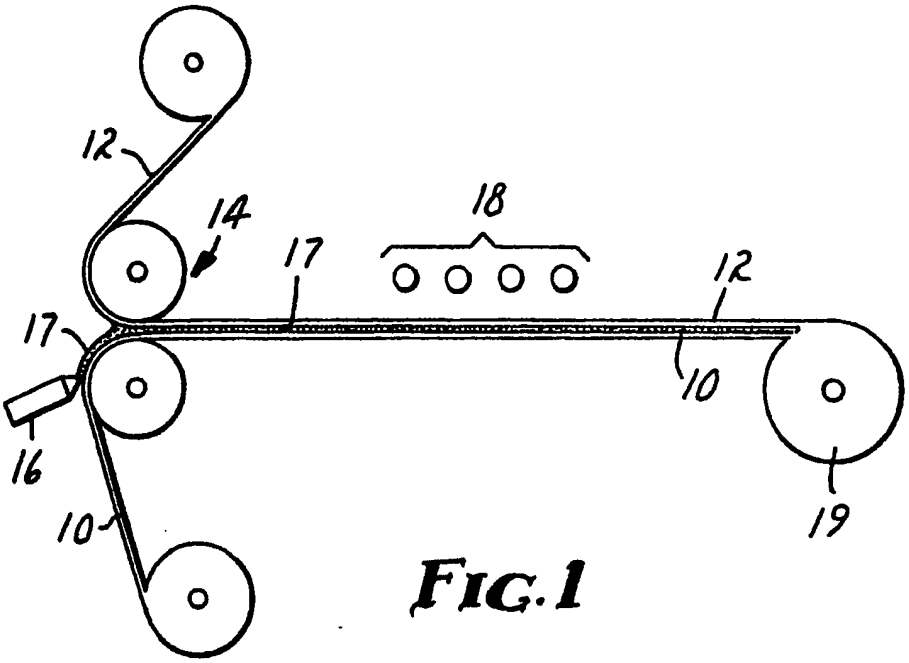

FIG. 1

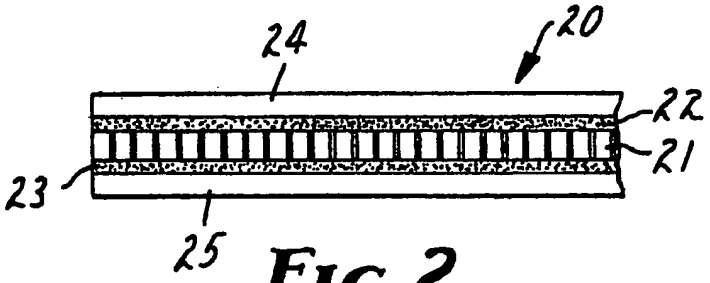

FIG. 2

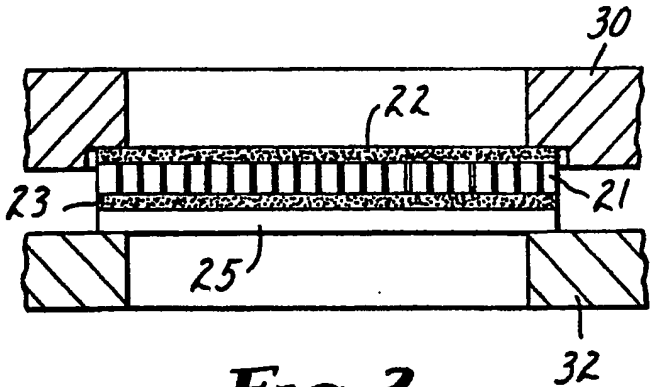

FIG. 3